



BSI Standards Publication

## Optical fibre cables

Part 3-20: Outdoor cables — Family  
specification for self-supporting aerial  
telecommunication cables

**National foreword**

This British Standard is the UK implementation of EN 60794-3-20:2016. It is identical to IEC 60794-3-20:2016. It supersedes BS EN 60794-3-20:2009 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee GEL/86, Fibre optics, to Subcommittee GEL/86/1, Optical fibres and cables.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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EUROPEAN STANDARD

**EN 60794-3-20**

NORME EUROPÉENNE

EUROPÄISCHE NORM

December 2016

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Supersedes EN 60794-3-20:2009

English Version

**Optical fibre cables - Part 3-20: Outdoor cables - Family  
specification for self-supporting aerial telecommunication cables  
(IEC 60794-3-20:2016)**

Câbles à fibres optiques - Partie 3-20: Câbles extérieurs -  
Spécification de famille pour les câbles de  
télécommunication aériens autoporteurs  
(IEC 60794-3-20:2016)

Lichtwellenleiter - Teil 3-20: Außenkabel -  
Familienspezifikation für selbsttragende LWL-Fernmelde-  
Luftkabel  
(IEC 60794-3-20:2016)

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European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

## European foreword

The text of document 86A/1733/FDIS, future edition 3 of IEC 60794-3-20, prepared by SC 86A "Fibres and cables" of IEC/TC 86 "Fibre optics" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60794-3-20:2016.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2017-07-20
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2019-10-20

This document supersedes EN 60794-3-20:2009.

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## Endorsement notice

The text of the International Standard IEC 60794-3-20:2016 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated :

IEC 60794-1-2                      NOTE    Harmonized as EN 60794-1-2.

IEC 60794-3 (Series)              NOTE    Harmonized as EN 60794-3 (Series).

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: [www.cenelec.eu](http://www.cenelec.eu).

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60793-2	-	Optical fibres - Part 2: Product specifications - General	EN 60793-2	-
IEC 60794-1-1	-		EN 60794-1-1	-
IEC 60794-1-21	-	Optical fibre cables -- Part 1-21: Generic specification - Basic optical cable test procedures - Mechanical tests methods	EN 60794-1-21	-
IEC 60794-1-22	2012	Optical fibre cables -- Part 1-22: Generic specification - Basic optical cable test procedures - Environmental test methods	EN 60794-1-22	2012
IEC 60794-3	2014	Optical fibre cables - Part 3: Outdoor cables - Sectional specification	EN 60794-3	2015
IEC 60811-203	-	Electric and optical fibre cables - Test methods for non-metallic materials -- Part 203: General tests - Measurement of overall dimensions	EN 60811-203	-
IEC 60811-302	-	Electric and optical fibre cables - Test methods for non-metallic materials -- Part 302: Electrical tests - Measurement of the d.c. resistivity at 23 °C and 100 °C of filling compounds	EN 60811-302	-

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**OPTICAL FIBRE CABLES –****Part 3-20: Outdoor cables – Family specification  
for self-supporting aerial telecommunication cables**

## FOREWORD

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International Standard IEC 60794-3-20 has been prepared by Subcommittee 86A: Fibres and cables, of IEC Technical Committee 86: Fibre optics.

This third edition cancels and replaces the second edition published in 2009. It constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) the specification has been streamlined by cross-referencing IEC 60794-1-1, IEC 60794-1-2 and the IEC 60794-3 series;
- b) an annex containing the MICE table has been deleted;
- c) an annex on examples has been added.

The text of this standard is based on the following documents:

FDIS	Report on voting
86A/1733/FDIS	86A/1760/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60794-3 series, published under the general title *Optical fibre cables – Part 3: Outdoor cables*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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## OPTICAL FIBRE CABLES –

### Part 3-20: Outdoor cables – Family specification for self-supporting aerial telecommunication cables

#### 1 Scope

This part of IEC 60794, which is a family specification, covers optical self-supporting aerial telecommunication cables. Requirements of the sectional specification IEC 60794-3 for duct, buried and aerial cables are applicable to cables covered by this standard.

Self-supporting aerial telecommunication cable in this context means a cable construction with sufficient strength members designed to be suspended on poles and similar devices without the aid of another supporting wire or conductor. ADSS cables installed on power lines which require special sheath material for tracking and erosion resistance and other constructions intended for high-voltage applications are not covered by this standard.

Detail specifications may be prepared based on this family specification.

NOTE IEC TR 62839-1 gives rules to build an environmental declaration if needed.

#### 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60793-2, *Optical fibres – Part 2: Product specifications – General*

IEC 60794-1-1, *Optical fibre cables – Part 1-1: Generic specification – General*

IEC 60794-1-21, *Optical fibre cables – Part 1-21: Generic specification – Basic optical cable test procedures – Mechanical tests methods*

IEC 60794-1-22:2012, *Optical fibre cables – Part 1-22: Generic specification – Basic optical cable test procedures – Environmental tests methods*

IEC 60794-3:2014, *Optical fibre cables – Part 3: Outdoor cables – Sectional specification*

IEC 60811-203, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 203: General tests – Measurement of overall dimensions*

IEC 60811-302, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 302: Electrical tests – Measurement of the d.c. resistivity at 23 °C and 100 °C of filling compounds*

#### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60794-1-1 apply.

## 4 Symbols and abbreviations

For the purposes of this document, the symbols and abbreviations given in IEC 60794-1-1 apply.

## 5 General Requirements

### 5.1 Optical fibres

The optical fibre shall conform to the requirements of IEC 60793-2. The fibre type shall be agreed between the customer and supplier. The cabled fibre shall conform to IEC 60794-3.

### 5.2 Cable elements

The cable elements shall conform to IEC 60794-3.

### 5.3 Optical fibre cable construction

The cable construction shall conform to IEC 60794-3.

## 6 Details of family requirements and test conditions for optical fibre cable tests

### 6.1 General

Tests on single-mode cables are typically carried out at 1 550 nm. For 1 625 nm applications, performance criteria shall be mutually agreed upon between the customer and supplier. Multimode cables are typically tested at 1 300 nm.

### 6.2 Tensile performance

#### a) Family requirements

For 1 % proof-tested fibres, the fibre strain at MAT shall not exceed 20 % of this fibre proof strain (equal to absolute 0,2 % strain). The attenuation increase shall not exceed 0,15 dB, and there shall be no change in attenuation after the test. Other criteria may be agreed upon between the customer and the supplier.

For fibres proof tested at higher levels, the safe MAT will not scale linearly with proof strain, so a lower percentage of the proof strain is applicable. For greater than 1 % up to 2 % proof-tested fibres, MAT shall be limited to 17 % of the proof-test strain (equal to absolute 0,34 % strain for 2 % proof tested fibres).

Under visual examination without magnification, there shall be no damage to the sheath or to the cable elements.

Other criteria may be agreed upon between the customer and the supplier.

#### b) Test conditions

Method:	IEC 60794-1-21, Method E1
	The cable shall be terminated with suitable dead end fittings adequate to the type of cable.
Tensile load on cable:	The specified MAT is applied and sustain this load level for 1 h.
Diameter of test pulleys:	1 m but not less than the minimum loaded bending diameter specified for the cable.

The number of fibres tested shall be representative of the cable design and shall be agreed upon between the customer and the supplier.

### 6.3 Crush

#### a) Family requirements

Under long term load, there shall be no change in attenuation at 1 550 nm during the test, and under short term load, there shall be no change in attenuation at 1 550 nm after the test. The short term load shall be equal or larger than the long term load.

Under visual examination, there shall be no damage to the sheath or to the cable elements. The imprint of the plate or mandrel on the sheath is not considered mechanical damage.

#### b) Test conditions

For Figure B.2 construction cables, the test shall be carried out without the suspension strand.

Method: IEC 60794-1-21, Method E3A

The default method is the plate/plate test, Method E3A. Optionally, the mandrel/plate test, Method E3B, may be conducted if requested by the detail specification. Short and long term tests may be conducted separately.

Load (short term):	Un-armoured cable:	1,5 kN
	Armoured cable:	2,2 kN
Load (long term):	Un-armoured cable:	0,75 kN
	Armoured cable:	1,1 kN

### 6.4 Impact

#### a) Family requirements

Under visual examination without magnification, there shall be no damage to the sheath or to the cable elements. The imprint of the striking surface on the sheath is not considered mechanical damage.

There shall be no change in attenuation after the test.

#### b) Test conditions

For Figure B.2 constructions, the test shall be carried out without the suspension strand.

Method: IEC 60794-1-21, Method E4

Number of impacts: One in 3 different places spaced not less than 500 mm apart

Impact energy:	Un-armoured cable:	10 J
	Armoured cable:	30 J

Striking surface radius: 300 mm

### 6.5 Repeated bending

#### a) Family requirements

Under visual examination without magnification, there shall be no damage to the sheath and to the cable elements.

#### b) Test conditions

For Figure B.2 construction cables, the suspension strand may be removed prior to testing.

Method: IEC 60794-1-21, Method E6

Number of cycles: 25, or different number of cycles may be applied in accordance with particular user conditions.

Load: Adequate to assure uniform contact with mandrel

Bending radius: 20 d

### 6.6 Torsion

#### a) Family requirements

Under visual examination without magnification, there shall be no damage to the sheath or to the cable elements.

There shall be no change in attenuation after the test.

b) Test conditions

For Figure B.2 cables, the suspension strand may be removed prior to testing.

Method:	IEC 60794-1-21, Method E7
Number of cycles:	5
Number of turns:	One half turn (through 180°) over the length of 2 m in each direction
Length under test:	2 m

## 6.7 Bend

a) Family requirements

There shall be no change in attenuation after the test.

b) Test conditions

Method:	IEC 60794-1-21, Method E11
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The default method is Method E11A. For large and/or stiff cables (e.g. where the mandrel diameter required is > 20 d), IEC 60794-1-21, Method E11B may be used.

Diameter of mandrel:	40 d
Number of turns / helix:	4
Number of cycles:	3
Test temperature:	Ambient (unless specifically requested otherwise)

For cable incorporating a non-metallic rod and/or metallic armouring, the diameter of the mandrel shall be limited to a value from 40 d to 80 d.

## 6.8 Bending under tension

a) Family requirements

MIT for the aerial cable designs shall be agreed between supplier and customer.

Under visual examination without magnification, there shall be no damage to the sheath and to the cable elements.

There shall be no change in attenuation after the test.

b) Test conditions

For Figure B.2 construction cable, the tests shall be carried out with the suspension strand included, and the direction of bend shall be that of the preferential bend direction of the cable.

Method:	IEC 60794-1-21, Method E18A
Tensile load on cable:	The specified MIT is applied for the test duration.
Diameter of mandrel:	40 d or the minimum loaded bending diameter specified for the cable
Bending angle:	45° ± 15°
Number of cycles:	20 moving cycles in each direction
Moving speed:	Between 1 m/s to 10 m/s
Length under test:	Minimum 9 m, minimum 2 m under bend tension
End preparation:	The cable should be terminated with the recommended dead end fitting.

## 6.9 Temperature cycling

### a) Family requirements

Attenuation measurements shall be taken during the last cycle.

In this document, acceptance criteria is interpreted with respect to this consideration (see IEC 60794-3:2014, Clause 8).

At  $T_{A1}$  and  $T_{B1}$  there shall be no change in attenuation as defined in IEC 60794-1-1.

At  $T_{A2}$  and  $T_{B2}$ , the change in attenuation coefficient shall be:

$\leq 0,15$  dB/km for single-mode fibre and shall be reversible to measurement uncertainty when measured in the 1 550 nm region.

$\leq 0,3$  dB/km for multimode fibre and shall be reversible to measurement uncertainty when measured in the 1 300 nm region.

On completion of the test, there shall be no change in attenuation.

### b) Test conditions

Method:	IEC 60794-1-22, Method F1
Sample length under test:	Finished cable, length of at least 1 000 m
High temperature, $T_{B2}$ :	+60 °C to +70 °C, depending on customer requirements
High temperature, $T_{B1}$ :	+30 °C to +60 °C, depending on customer requirements
Low temperature, $T_{A1}$ :	-10 °C to -20 °C, depending on customer requirements
Low temperature, $T_{A2}$ :	$T_{A1}$ to -40 °C or -45 °C, depending on customer requirements
Number of cycles:	2, but additional cycles may be required in accordance with particular customer requirements.
For warmer or colder climates, $t_1$	temperature cycling test dwell time to stable temperature is reached.

Alternative high and low temperatures may be agreed between the customer and the supplier

## 6.10 Water penetration

### a) Family requirements

The cable shall not propagate water longitudinally according to requirements of IEC 60794-1-22, Method F5B (jelly-filled cables) or Method F5C (dry water-blocked), unless otherwise agreed between the customer and the supplier.

### b) Test conditions

Method:	IEC 60794-1-22, Method F5B or F5C, as applicable
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## 6.11 Aging

### a) Family requirements

Method:	IEC 60794-1-22:2012, Method F9, 11.5
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### b) Test conditions

Method:	IEC 60794-1-22, Method F9
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## 6.12 Installation conditions

See IEC TR 62691.

## Annex A (normative)

### Blank detail specification and minimum requirements

#### A.1 Cable description

(1) Prepared by		(2) Document No: Issue: Date:
(3) Available from	(4) Generic specification: Sectional specification:	IEC 60794-1-1 IEC 60794-3
(5) Additional references:		
(6) Cable description:		
(7) Cable construction:		
Optical fibres		
Range of fibre count		
Modularity		
Construction <ul style="list-style-type: none"> <li>– Single coloured fibre</li> <li>– Tube, waterblocked</li> <li>– Tube, non-waterblocked</li> <li>– Micromodules, waterblocked</li> <li>– Micromodules, non-waterblocked</li> <li>– Slotted core, waterblocked</li> <li>– Slotted core, non-waterblocked</li> <li>– Tight secondary coating</li> <li>– Ribbon in slotted core</li> <li>– Ribbon in tube</li> <li>– Tube in tube</li> <li>– Central member, metallic</li> <li>– Central member, non-metallic</li> <li>– Core filling, jelly</li> <li>– Core filling, water swellable materials</li> </ul> Lay-up <ul style="list-style-type: none"> <li>– Stranding (helical or SZ)</li> <li>– Single unit</li> <li>– Hybrid configuration</li> </ul> Insulated copper conductors Inner sheath Peripheral strength member <ul style="list-style-type: none"> <li>– Metallic</li> <li>– Non-metallic</li> </ul>		Additional remarks
Moisture barrier <ul style="list-style-type: none"> <li>– Single coated aluminium tape</li> <li>– Double coated aluminium tape</li> <li>– Double coated steel tape</li> <li>– Hermetic barrier (metal tube)</li> </ul> Outer sheath Additional armouring <ul style="list-style-type: none"> <li>– Non-metallic armouring</li> <li>– Metallic armouring</li> </ul> Additional outer sheath		

Figure B.2 construction – Metallic suspension strand – Non-metallic suspension strand	
Circular self-supporting construction Marking identification – Customer requirement – Identification of supplier	
(8) Application information:	
Application Maximum outer diameter ( $d$ ) Long term tensile load ( $T_L$ ) Installation load ( $T_M$ ) Minimum bending diameter for no load bending Minimum bending diameter for rated load bending Installation and operating conditions Temperature range: – Transport and storage – Installation – Operation Manufacturing cable length – Typical – Nominal/tolerances: Installation attributes – Twisting (for Figure B.2 cable): – Nominal span length: – Maximum span length: – Nominal installation sag: – Ice loading: – Wind loading: – Combination of ice and wind loading:	mm N N mm or $n \times d$ mm or $n \times d$  °C °C °C  m –0 +□1 %  1 turn per ...m cable m m m N/m N/m N/m

**A.2 Cable construction**

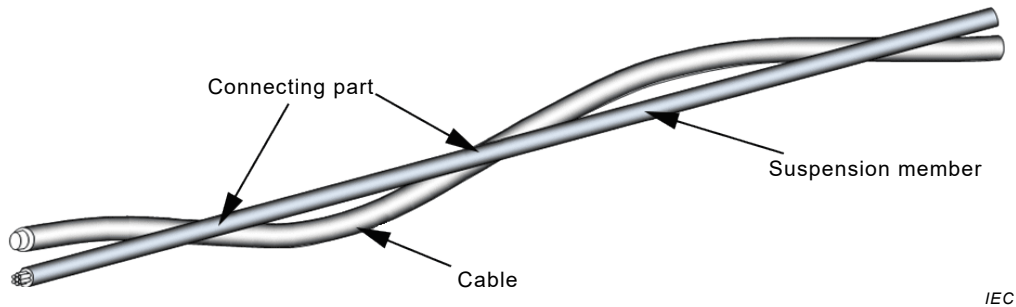
Characteristics (9)	IEC 60794-3:2014 Subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Lay-up	6.2	According to DS	Visual inspection	
Cable core	6.3	According to DS	Either IEC 60794-1-21, Method E14, or IEC 60811-302	
Filling compound (if used)		According to DS		
Dry blocking compound	6.3	According to DS	u.c	
Strength member – central – peripheral	6.4	According to DS	Visual inspection	
Moisture barrier Metallic tapes	6.5	According to DS IEC 60794-3:2014, 6.5		
Outer cable sheath Material	6.6	IEC 60794-3:2014, 6.6.3		
Minimum sheath thickness		According to DS	IEC 60811-203	
Outer cable diameter		According to DS	IEC 60811-203	
Optional protection		According to DS		
Sheath marking Configuration, dimensions Abrasion resistance	6.7	According to DS	Visual inspection	
		According to DS	IEC 60794-1-21, Method E2B Method 1  Or IEC 60794-1-21, Method E2B Method 2	Steel needle diameter $d = 1,0$ mm load: 4 N  Wool or rayon felt, weight $\geq 450$ g
Sheath abrasion	8.10	According to DS	IEC 60794-1-21, Method E2A	
Cable length			u.c	
<b>Key</b>				
DS detail specification				
u.c under consideration				



## Annex B (informative)

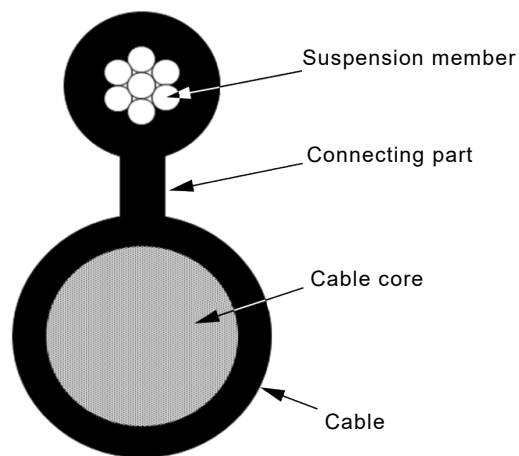
### Examples of cables construction and installation

Figure B.1, Figure B.2 and Figure B.3 provide examples for self-supporting aerial telecommunication cables



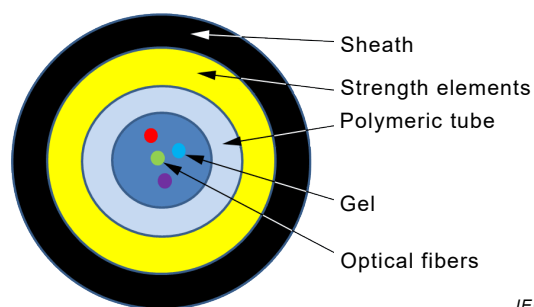
IEC

**Figure B.1 – Lashed and suspended cable**



IEC

**Figure B.2 – SSW cable (self-supporting with windows)**



IEC

**Figure B.3 – Round aerial self-supported cable**

## Bibliography

IEC 60794-1-2, *Optical fibre cables – Part 1-2: Generic specification – Cross-reference table for optical cable test procedures*

IEC 60794-3 (all parts), *Optical fibre cables – Part 3: Outdoor cables*

IEC TR 62691, *Optical fibre cables – Guide to the installation of optical fibre cables*

IEC TR 62839-1, *Environmental declaration – Part 1: Wires, cables and accessory products – Specific rules*

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